

A REVISION OF BARTONIA AND OBOLARIA  
(GENTIANACEAE)<sup>1</sup>

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I. THE GENUS BARTONIA MUHL.

The generic history of *Bartonia* Muhl. (named in honor of Professor Benjamin Smith Barton, 1766–1815, of Philadelphia, as was *Bartonis* Sims of the *Loasaceae*), has been rather thoroughly reviewed by Fernald and Weatherby (1932) in an amusing little paper entitled "*Bartonia*, a Comedy of Errors." Briefly, these authors argued in favor of retention of the name and provided a list of generic synonymy with bibliography. *Bartonia* was subsequently conserved just twenty years later in order to avoid confusion with Sims's genus.

Willdenow credited Muhlenberg with the discovery of the genus and provided a description in 1801 but the single species *B. tenella* ascribed to it is usually credited directly to Willdenow. Michaux independently described *Centaurella* in 1803 with two species, *C. verna* and *C. paniculata*. Britton, Sterns and Poggenberg found that *B. tenella* Willd. had been described previously as *Sagina virginica* by Linnaeus and made the combination *B. virginica* (L.) BSP.

Persoon in 1805 erected the genus *Centaurium* (not Hill, 1756) describing *C. autumnale* based on *Centaurella paniculata* Michaux. Muhlenberg then made the combinations *Bartonia verna* (Michx.) Muhl. and *B. paniculata* (Michx.) Muhl. in his Catalogue of 1813. Robinson then made a superfluous combination *B. paniculata* (Michx.) Robins. when he decided that Small's *Bartonia lanceolata* described in 1903 was synonymous with it.

Pursh did not simplify the situation when in 1814 he recognized three species and one variety employing Michaux's genus *Centaurella*. These were *C. vernalis* and a  $\beta$  *uniflora*, *C. aestivalis*

<sup>1</sup> Contribution No. 1748 from the Botany and Plant Pathology Division, Science Service, Canada Department of Agriculture, Ottawa, Ontario.

and *C. autumnalis*. The first two entities are perhaps segregates of *Bartonia verna* but their identities are still in doubt because the types have not been located. I have included them in the synonymy of *C. verna* based on the description. Again the type of *C. aestivalis* has not been located and Pursh's description is inadequate to establish its position. The last, *C. autumnalis*, included both *C. paniculata* Michx. and *Sagina virginica* L. because the type of the latter, Clayton 649, is cited. Pursh made no mention of Persoon's earlier *Centaureum autumnale*.

Grisebach in his *Species Gentianearum* of 1839 employed Michaux's *Centaurella* containing three species, *C. autumnalis* Pursh, *C. verna* Michx. and a *C. moseri* Steudel & Hochstein. He also described a  $\beta$  *brachysepala* of *C. autumnalis*. Grisebach's treatment is similar for De Candolle's *Prodromus* of 1845.

Asa Gray in the *Synoptical Flora* employed *Bartonia* as the generic name recognizing two species *B. tenella* and *B. verna*. *C. moseri* he regarded as synonymous with *B. tenella* saying, ". . . an occasional form, with leaves or scales and branches mostly alternate."

*Centaurella moseri* was subsequently transferred to *Bartonia*, the combination attributed to Robinson & Schrenk by Gilg in the *Pflanzenreich* in 1895. The *Pflanzenfamilien* treatment of the Gentianaceae by Gilg placed *Bartonia* between *Canscora* and *Obolaria* in his *Erythraeinae*, enumerating three species, *B. tenella*, *B. verna* and *B. moseri*.

Three years after the Robinson & Schrenk transfer, Robinson described *Bartonia iodandra* from Newfoundland and promoted a rash of investigation by Fernald. In 1921 Fernald described *B. iodandra* var. *sabulonensis* from Sable Island, Nova Scotia, and in the following year he transferred both *B. iodandra* and his own variety *sabulonensis* to the status of varieties of *B. paniculata*. Following a tremendous amount of field work in Nova Scotia, Fernald found so many specimens that could not be placed in either *B. paniculata* or var. *iodandra* that he created a variety *intermedia* to take care of them. Except for a form of *B. virginica*

described by Victorin in 1919, the genus has remained relatively untouched until now.

Chromosome counts have been made by Rork (1949) of *Bartonia paniculata* from her own preparations and a count was obtained for *B. virginica* by the same worker from a slide supplied by Uhl. A count of  $n=26$  was obtained for both species. From material collected in the field by the author at St. Pierre de Howick, Quebec, R. J. Moore of this Division obtained a count of  $2n=ca. 52$  from a squash of ovary tissue. This material, of course, was *B. virginica*. No count has been obtained from Newfoundland or Nova Scotian material. No chromosome count has been recorded for *Bartonia verna*.

Flowering and fruiting dates taken from herbarium specimens are presented in Table 1. These are actually collection dates but since the species flower for long periods they are indicative of the flowering time for each population. Evidently these dates coincide for *B. virginica* and *B. paniculata* but differ widely for *B. verna*.

*B. verna* exhibits the typical distribution of a southern coastal plain species. *B. paniculata* and *B. virginica* are sympatric over a large portion of their ranges. The former extends further west in the southern portion of the coastal plain and further north in the northern portion than the latter. *B. virginica* on the other hand, tends to extend farther inland into the Great Lakes region. The disjunction in distribution between Maine and Nova Scotia can be explained by post-glacial flooding of the coastal plain so that migration northward must have followed in the wake of the receding glacier before this area was inundated. This theme has been discussed by Fernald.

Morphologically *B. verna* is a clear-cut species while the others are not. The *paniculata* and *iodandra* populations intergrade quite freely; occasional intermediates occur between *B. paniculata* and *B. virginica*. Although the two species are sympatric over a

TABLE 1. PHENOLOGY OF BARTONIA

Month	Week	<i>B. virginica</i>	<i>B. paniculata</i>		<i>B. verna</i>
			<i>ssp. panic.</i>	<i>ssp. iodandra</i>	
July	1	FL	—	FL	—
	2	FL	—	—	—
	3	FL	—	—	—
	4	FL	FL	—	—
August	1	FL	FL	FL	—
	2	FLR	FL	FL	—
	3	FLR	FL	FL	—
	4	FLR	FL	FLR	—
September	1	FLR	FL	FLR	—
	2	FLR	FL	FLR	—
	3	FLR	FLR	FR	—
	4	FLR	FLR	FR	—
October	1	FR	FR	FR	—
	2	FR	—	FR	—
	3	FR	FR	—	—
	4	FR	—	—	—
November	1	—	FR	—	—
	2	FR	—	—	<b>FL</b>
	3	—	—	—	FL
	4	—	—	—	—
December	1	—	—	—	—
	2	—	—	—	—
	3	—	—	—	—
	4	—	—	—	FL
January	1	—	—	—	FL
	2	—	—	—	—
	3	—	—	—	—
	4	—	—	—	FL
February	1	—	—	—	FL
	2	—	—	—	FL
	3	—	—	—	—
	4	—	—	—	—
March	1	—	—	—	FL
	2	—	—	—	FLR
	3	—	—	—	FLR
	4	—	—	—	—
April	1	—	—	—	FR
	2	—	—	—	—
	3	—	—	—	—
	4	—	—	—	—

FL — in flower; FR — in fruit; FLR — in both flower and fruit.

considerable portion of their range, intergrades are more or less restricted to the coastal plain area. On the other hand the two species frequently remain quite distinct in the same region, due perhaps to restricting habitat factors. Herbarium sheets bearing a number of plants may contain occasional intermediates. These plants may show *B. virginica*-type flowers or fruits with *B. paniculata*-type leaf arrangement or other character combinations.

The following specimens may serve to illustrate: *Bissell & Graves* 22294, Port Mouton, N. S. — somewhat intermediate between the *virginica* and the *iodandra* type; *Fernald & Long* 24356, Shelburne, N. S. — most are *B. virginica* but a few have alternate leaves; *Torrey Herb.* N. Y. — a mixture: #1 and #3 sterile intermediates, #4 *B. virginica*, #5 *B. paniculata*; *Seymour* 1996, Martha's Vineyard — 3 of 4 plants *B. virginica*, the other intermediate; *Tracy s.n.*, Ocean Springs, Mississippi — some plants of *B. paniculata* approaching *B. virginica*; *Chapman Herb.* Apalachicola, Florida — plant #1 intermediate, #2 *B. paniculata*, #3 and #4 *B. virginica*; *Ferguson* 5208, Speonk, N. Y. — *B. virginica*, some approaching *B. paniculata*.

However, the following sheets have both species on the same sheet with no intermediates: The MO sheet of the *Gray Exsiccatae* 390 — *B. virginica* but one plant of the *iodandra* group; *Lighthipe s.n.*, Ocean Beach, N. J. — left-hand plant *B. paniculata*, right hand plant, *B. virginica*; *Chickering s.n.*, Kennebunk, Maine — 1 plant of *B. virginica*, 3 of *B. paniculata*. Only a selected number of examples are given here.

With both species having similar chromosome numbers and, according to Rork's sketches, similar chromosome morphology and with similar flowering times and sympatric distribution, it would seem likely that hybridization is within the realm of possibility. Since the actual percentage of such intermediates is low with respect to number of collections and extremely low with respect to the total number of plants examined, I feel that the species are best treated as separate at least until such time as mass sampling can be made and crossing experiments carried out to clarify the situation.

Species relationships would be placed on a firmer basis by further cytological studies. Obviously a chromosome count is immediately required for *B. verna*. Morphologically, the poorly developed corolla tube, decurrent stigmas and variable position of leaf scales would suggest that this species is the more primitive;

the distinct corolla tube, distinct stigmas and definite position of leaf scales would indicate that the other two species are more advanced. Of the two it is difficult to set one above the other. It would appear that the northern subspecies of *B. paniculata* has evolved by selection from occasional crosses and backcrosses between *B. virginica* and *B. paniculata*. The presence of pointed anthers in the northern group rather suggests this. A biometrical study employing anther shape as a character may lend support to this idea.

This study has been based on the collections of most of the eastern North American herbaria. The smaller herbaria were added in order to try to fill out the range of the species in more detail. Thanks are due to the curators of the herbaria listed and to those of the British Museum of Natural History and the Paris Museum for their assistance in obtaining photographs of type material. I should like to thank Dr. B. Boivin of this Division for reading the manuscript. Material from the following herbaria has been seen: DAO, GH, NY, CAN, TRT, US, TENN, MO, OKLA, FSU, GA, TEX, NCU, FLAS, SMU, BUS, NEBC. Although a formidable list, this does not represent a very large number of specimens. Material of the genus *Obolaria* is included.

Selected representative specimens of each species are cited and a few selected intermediate sheets have been discussed. For each entity a list of the counties per State or Province is given to supplement the distribution maps. The publication of an Index of Exsiccatae is impractical.

#### SYSTEMATIC TREATMENT

**Bartonia** Mühl. ex Willd. Ges. Naturf. Freunde Berlin Neue Schr. 3: 444. 1801, *nomen conserv.*

*Agina* Neck. Elem. Bot. 2: 153. 1790, nom. rejic.

*Centaurella* Michx. Fl. Bor. Amer. 1: 97, 98 t. 12. f. 1 & 2. 1803.

*Centaureium* Pers. Synops. 1: 137. 1805, non Hill, 1756.

*Andrewsia* Spreng. Syst. 1: 368 & 428. 1825; non *Andreusia* Vent., 1804.

Filiform, erect saprophytic annuals. Leaves reduced to minute, oppo-

site or alternate subulate scales. Inflorescence cymose or racemiform, frequently 1-flowered. Calyx with a short tube or the lobes nearly free, the outer overlapping the inner. Corolla deeply 4-lobed, marcescent, campanulate, each lobe with a single vascular strand. Stamens 4, alternate with the lobes of the corolla, the filaments short, attached at the sinuses of the corolla lobes, the dart-shaped to blunt anthers introrse and frequently deciduous after anthesis. Ovary sessile, unilocular, bicarpellate, the placenta parietal, the ovules covering the entire inner surface. Fruit an ovoid, thin-walled capsule, dehiscent along the sutures. Seeds very numerous, minute, ellipsoid, smooth to minutely reticulate. —Type species: *B. tenella* Mühl. ex Willd.

## KEY TO THE SPECIES

- A. Aestival to autumnal flowering. Corolla slightly longer to twice as long as the calyx, the lobes 2–4 mm. long, lanceolate to oblong.
- B. Leaf scales essentially opposite, the numerous nodes progressively more crowded towards the base; corolla lobes oblong, the apex apiculate, crose to entire; capsule dehiscing below the elongate style ..... 1. *B. virginica*.
- BB. Leaf scales essentially alternate, the few nodes but slightly closer towards the base; corolla lobes lanceolate, the apex inapiculate, entire, acute; capsule dehiscing by terminal separation of the short style ..... 2. *B. paniculata*.
- AA. Vernal flowering. Corolla three times the length of the calyx, the lobes 6–11 mm. long, obovate to spatulate..... 3. *B. verna*

1. *Bartonia virginica* (L.) BSP. Prel. Cat. N.Y. Pl. 36. 1888

*Sagina virginica* L. Sp. Pl. 2: 128. 1753. (*Clayton 649* BM type, photo DAO!). *Bartonia tenella* Mühl. ex Willd. in Ges. Naturf. Freunde Berlin, Neue Schrift 3: 444. 1801. (*Muhlenberg s.n.* B. Willd. Herb. 2991 type, photo DAO!). *Centaurella autumnalis* Pursh, Fl. Amer. Sept. 1: 100. 1814, pro parte typ. incl. based on *Sagina virginica* L. *Andrewsia autumnalis* (Pursh) Spreng. Syst. Veg. 1: 428. 1825. *Centaurella moseri* Steudel & Hochstein ex Griseb. Gen. et Sp. Gent. 308. 1839. *Centaurella autumnalis* Pursh  $\beta$  *brachysepala* Griseb. Gen. et Sp. Gent. 308. 1839, ex char. (*Drummond s.n.* type presumably London). *Bartonia moseri* (Steud. & Hochst. ex Griseb.) Robins. & Schrenk ex Gilg in Engl. & Prantl Nat. Pflanzef. 4, abt. 2: 76. 1895. *Bartonia virginica* (L.) BSP. forma *abortiva* Vict. in Roy. Soc. Can. Proc. & Trans. Ser. III. Sect. V. 13: 113. 1919. (*Victorin 19570* MT type!).

Annuals 0.4–4.5 (av. 2.2) dm. tall, erect, simple or branched above, the stem slender, wiry or stout, terete or angled, occasionally slightly winged, frequently twisted, the nodes numerous and becoming progressively closer together towards the usually purple base. Leaves 0.9–4.7 (av. 2.4) mm. long, scale-like, subulate, decussate, usually opposite or subopposite, the lowermost occasionally alternate. Flowers in simple

terminal cymes with solitary flowers or branches in the lower axils. Calyx lobes 0.4–1.1 (av. 0.74) mm. wide, 2.0–3.5 (av. 2.7) mm. long, almost distinct, subulate-lanceolate, carinate. Corolla 2.4–4.2 (av. 3.4) mm. long, greenish-yellow, the petals united in the lower third, the lobes 0.75–1.2 (av. 1.1) mm. wide, oblong, obtuse, mucronate, erose or entire, with a prominent nerve. Stamens 1.5–3.5 (av. 2.53) mm. long (measured from the base of the corolla), flattened, the anthers 0.6–1.2 (av. 0.91) mm. long, oblong, mucronate, frequently purple. Pistil 2.5–4.5 (av. 3.6) mm. long, ovate, the style 1.0–2.0 (av. 1.3) mm. long, the stigmas decurrent. Capsule 4.0–5.5 (av. 4.8) mm. long, ovate, dehiscence below the persistent style. Seeds averaging 0.14 x 0.08 mm., extremely numerous, light brown with a testa of irregular cells.

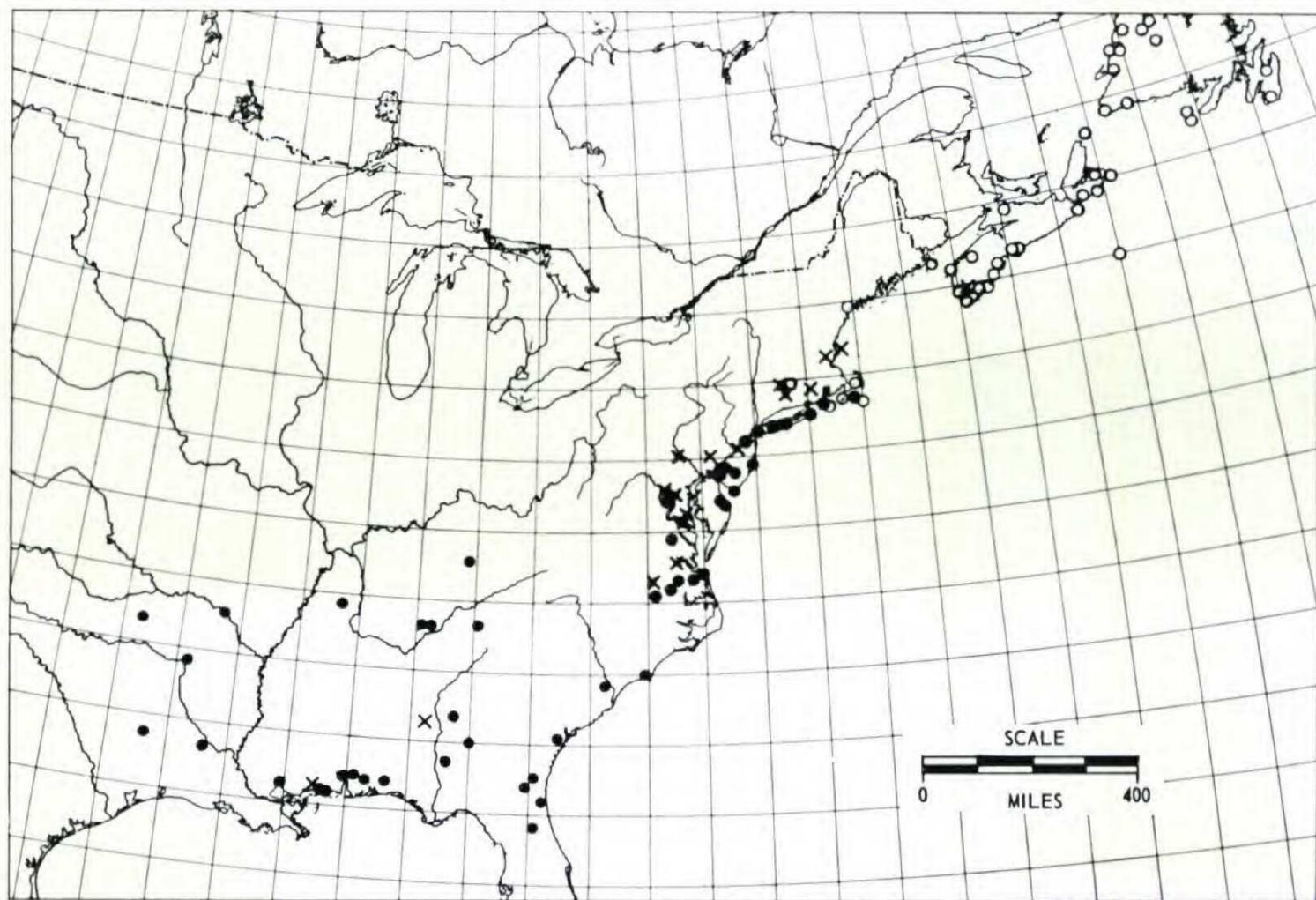
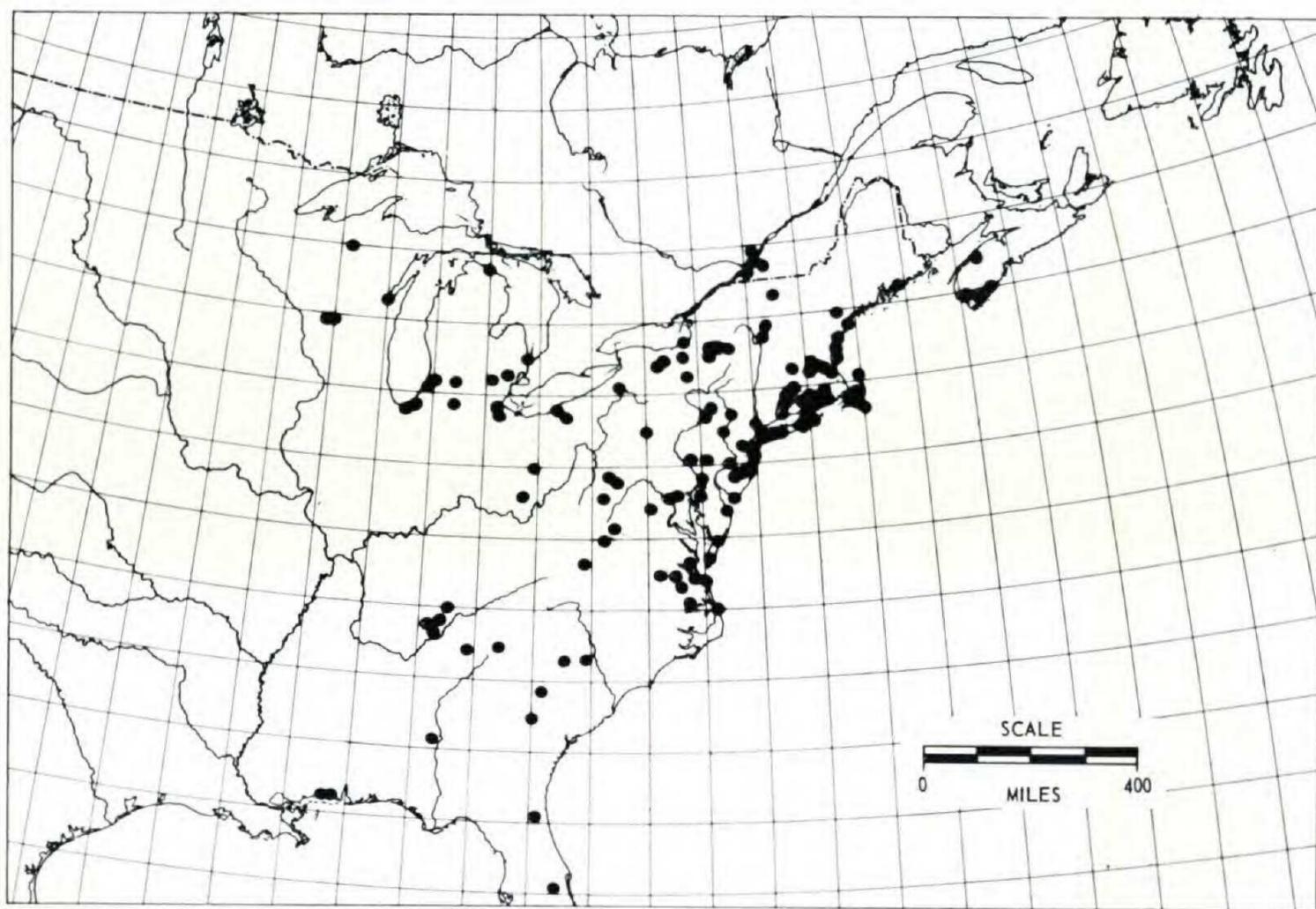
*Corema barrens*, sphagnous bogs, margins of swamps, peaty and sandy lake shores, openings in brush and in dry thickets. Flowering from early July until late September; fruiting from early August until November.

Common Names: Virginian Bartonias; Virginian Screwstem.

Representative specimens: N.S. Queens County, Louis Lake, Port Joli, *Gray Exsiccatae 390, Fernald, Linder & Long s.n.* (DAO, GA, GH, MO, TENN, NY, TEX, TRT, US). Que. Terrebonne County, Ste. Therese, *Victorin, Rolland & Meilleur 45750* (DAO, GH, US). N.Y. Cattaraugus County, Steamberg, *Alexander & House 12979* (GH, US). Va. Northampton County, Eastville, *Fernald & Long 5420* (MO, NY, US). Wisc. Brown County, *Shuette s.n.* (NY, US).

Distribution by Counties: CANADA. NOVA SCOTIA: Annapolis, Lunenburg, Queens, Shelburne and Yarmouth. QUEBEC: Chambly, Chateauguy, Huntingdon and Terrebonne. UNITED STATES. ALABAMA: Lee. CONNECTICUT: East Haven, Hartford, New Haven, New London, Southington and Stratford. DELAWARE: SUSSEX. DISTRICT OF COLUMBIA. FLORIDA: Brevard, Gulf, Nassau and Osceola. GEORGIA: Bartow, Chatham, Jenkins and Miller. INDIANA: Lake, Porter and Steuben. LOUISIANA: St. Tammany. MAINE: Cumberland, Hancock, Oxford and York. MARYLAND: Anne Arundel, Cecil, Frederick, Garrett, Prince Georges, Queen Annes and Worcester. MASSACHUSETTS: Barnstable, Dukes, Essex, Hampden, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk and Worcester. MICHIGAN: Berrien, Kalamazoo, Oakland, Presque Isle, St. Clair, Van Buren and Washtenaw. MISSISSIPPI: Harrison and Jackson. NEW JERSEY: Atlantic, Burlington, Camden, Cape May, Cumberland, Essex, Hudson, Middlesex, Monmouth, Morris, Ocean, Passaic and Sussex. NEW YORK: Cattaraugus, Cayuga, Herkimer, Madison, Nassau, Oneida, Ontario, Oswego, Putnam, Richmond, Seneca, Suffolk, Tompkins, Warren, Washington, Wayne and Westchester. NORTH CAROLINA: Chowan, Dare, Durham and Macon. OHIO: Cuyahoga, Jackson, Licking, Lucas, Summit and Wood. PENNSYLVANIA: Center, Chester, Lackawanna, Lancaster, Monroe, Philadelphia and Pike. RHODE ISLAND: Newport, Providence and Washington. SOUTH CAROLINA: Aiken, Darlington and Kershaw. TENNESSEE: Coffee, Cumberland, Marion, Morgan and Sequatchee. VERMONT: Chittenden. VIRGINIA: Accomac, Augusta, Bath, Dinwiddie, Fauquier, James City, Nansemond, Norfolk, Northampton, Prin-

cess Anne, Southampton and Sussex. WEST VIRGINIA: Preston, Raleigh, Randolph and Tucker. WISCONSIN: Brown, Jackson, Munroe and Vilas.



MAP 1. Distribution of *Bartonia virginica*. MAP 2. Distribution of *Bartonia paniculata*: solid dots: ssp. *paniculata*. open circles: ssp. *iodandra*. crosses: putative intermediates between *B. virginica* and *B. paniculata*.

The original description of *Centaurella moseri* gave "Cymis racemiformibus, ramis alternis!", and "foliis non oppositis!" Other characters given seem to fit *B. paniculata* quite closely. The specimens cited are: "Salzburg Township Pennsylvaniae (Moser!); Covington (Drummond!). — Fl. Septembri!-".

Grisebach gave the source of the material as "ab Union. Württemberg," which may mean that the holotype material is at Stuttgart if it still exists. However, there is a collection at the New York Botanical Garden labelled, "Salzburg Taunship Pennsylvaniae, Unio itiner C. J. Moser Jul. Aug. 1832." This has both a printed and handwritten label. There is a duplicate of this at the Missouri Botanical Garden. In addition to these sheets I have seen the Drummond specimen from Covington, Louisiana. Both collections are undoubtedly *B. virginica* in spite of the description, but Grisebach stated so clearly the characters of his plant that it is quite possible that he had a mixed collection. Until the type comes to light it is pointless to select a lectotype. For the present I am placing *C. moseri* provisionally in the synonymy of *B. virginica*.

2. **Bartonia paniculata** (Michx.) Muhl. Cat. 16. 1813.

*Centaurella paniculata* Michx. Fl. Bor. Am. 1: 98. f. 1. 1803. (*Michaux s.n.* P type, the sheet from the Richard Herb. (see explanation below), photo DAO!).

Annuals, 0.3–3.9 dm. tall, the green or purple angled stems strict to twining, simple or branched above with curved ascending branches. Leaf-scales 0.5–3.0 mm. long, alternate, subulate. Flowers solitary or in simple cymes with or without axillary ones below. Calyx tube evident or the frequently crinkle-keeled, ovate to lanceolate lobes barely united at the base, the lobes 1.5–3.2 mm. long, 0.5–1.1 mm. wide, the outer lobes shorter and wider than the inner. Corolla white to somewhat erubescens, the lobes oblong to tapered oblong, acute to slightly mucronate with a single nerve or with two lateral ones sometimes evident. Stamens 2.2–5.0 mm. long (measured from the base of the corolla), the anthers varying from 0.3–0.6 (av. 0.4) long in the typical subspecies to 0.5–1.0 (av. 0.7) mm. long in the northern subspecies, usually with a rounded apex. Pistil ovate, with an evident style, the stigmas decurrent along the whole length. Capsule ovate, the style persistent, dehiscence apical by separation of the stigmas. Seeds very small, light brown with a testa of inflated cells, extremely numerous.

I select the Michaux collection from the Richard herbarium in the main collection at Paris as the holotype of *Centaurella paniculata* Michx. The first and last lines of the handwritten label are in Richard's handwriting; the central portion is in Michaux's hand. The separate Michaux collection labelled *C. paniculata* I was surprised to find is perfectly good *B. virginica*.

KEY TO THE SUBSPECIES OF *B. PANICULATA*

- A. Plants slender, lax, frequently twining, green or essentially so; anthers usually yellow, about 0.5 mm. long, rounded at the apex.  
 ..... 2a. *B. paniculata* ssp. *paniculata*.
- AA. Plants strict or stout, the stem frequently thickened upwards and purple throughout; anthers usually purple or if yellow, the filaments frequently purple, 0.5–1.0 mm. long, rounded or apiculate.  
 ..... 2b. *B. paniculata* ssp. *iodandra*

2a. *Bartonia paniculata* (Michx.) Muhl. ssp. *paniculata*

*Centaureium autumnale* Pers. Syn. Pl. 1: 137. 1805, ex char. *Bartonia tenella* Muhl. ex. Willd.  $\beta$  *brachiata* Wood, Class-book, ed. 2. 586. 1866, ex char. excl. syn. *Bartonia lanceolata* Small, Fl. SE. U.S. 932, 1336. 1903. (*Chapman s.n.* NY, type!). *Bartonia paniculata* (Michx.) Robinson in RHODORA 10: 35. 1903, superfluous comb.

Plants 1.0–3.9 (av. 2.5) dm. tall, the slender usually green but rarely purple stem erect or twining. Flowers in simple cymes and with axillary flowers below. Calyx lobes slightly united at the base, frequently crinkle-keeled, the sinuses acute, the lobes 1.5–2.8 (av. 2.1) mm. long, 0.5–1.0 (av. 0.75) mm. wide, ovate-lanceolate to lanceolate. Corolla 3.0–5.0 (av. 3.8) mm. long, white, the tube  $\frac{1}{3}$ – $\frac{1}{2}$  the length of the corolla, the tapered oblong lobes 1.0–1.5 (av. 1.1) mm. wide, acute. Stamens 2.2–3.8 (av. 2.8) mm. long (measured from the base of the corolla), the yellow anthers 0.3–0.6 (av. 0.4) mm. long, the tips rounded. Pistil 2.0–5.0 (av. 3.3) mm. long, the style 0.5–1.5 (av. 0.9) mm. long. Capsule 3.5–5.8 (av. 4.2) mm. long. Seeds averaging 0.19 x 0.12 mm., 1000 to 1500 per capsule (actual count).

Sandy and sphagnous bogs, grassy swamps, cedar swamps, wet open woods, sandy and peaty shores of ponds. Flowering from late July until late September, fruiting from mid-September until November.

Common Name: Screwstem.

Representative specimens: Mass. Nantucket Island, Bicknell s.n. (NY). N. J. Middlesex County, Cheesequake State Park, *Alexander & Gilly* 428 (NY). N. Y. Suffolk County, Bridgehampton, *Ferguson* 6277 (NY). Tenn. Coffee County, Manchester, *Svenson* 9124 (GH). Va. Greenville County, Dahlia, *Fernald & Long* 9403 (GH, NY, US).

Distribution by counties: ALABAMA: Mobile. ARKANSAS: Hempstead and Pulaski. CONNECTICUT: Hartford, Litchfield. DELAWARE: Sussex. DISTRICT OF COLUMBIA. FLORIDA: Duval, Okaloosa, Putnam, Santa Rosa and Walton. GEORGIA: Camden, Chatham, Fannin, Randolph, Screven, Sumter, Talbot. KENTUCKY: Laurel. LOUISIANA: Rapides. MARYLAND: Prince Georges. MASSACHUSETTS: Barnstable, Duke and Nantucket. MISSISSIPPI: Harrison and Simpson. NEW JERSEY: Atlantic, Burlington, Camden, Cape May, Gloucester, Middlesex, Monmouth, Ocean and Salem. NEW YORK: Kings, Nassau, Queens, Suffolk. NORTH CAROLINA: Brunswick. OKLAHOMA: LeFlore. PENNSYLVANIA: Location unknown. TENNESSEE: Carroll, Coffee, Fentress and Grundy. TEXAS: Houston. VIRGINIA: Caroline, Greenville, Nansemond, Prince George, Southampton and Sussex.

2b. *Bartonia paniculata* (Michx.) Muhl. ssp. *iodandra*  
(Robins.) stat. nov.

*Bartonia iodandra* Robins. in Bot. Gaz. **26**: 47. 1898 (*Robinson & Schrenk* 5 GH type, isotypes MO, NY, US!). *Bartonia paniculata* (Michx.) Muhl. var. *iodandra* (Robins.) Fern. in RHODORA **23**: 288. 1922. *Bartonia iodandra* Robins. var. *sabulonensis* Fern. in Proc. Bost. Soc. Nat. Hist. **36**: 89. 1921. (*St. John* 1307 GH type, isotypes NY, US!). *Bartonia paniculata* var. *sabulonensis* Fern. in RHODORA **23**: 288. 1922. *Bartonia paniculata* var. *intermedia* Fern. in RHODORA (**23**: 287. 1922. (*Fernald & Long* 22299 GH type, isotype NY!).

Plants 0.3–2.5 (av. 1.2) dm. tall, the usually purple angled stems occasionally stout. Flowers in simple cymes or solitary or with axillary flowers below. Calyx tube frequently well-developed, slightly winged at the base, the sinuses rounded, the lobes 1.5–3.2 (av. 2.4) mm. long, 0.5–1.1 (av. 0.8) mm. wide, ovate to lanceolate. Corolla 3.0–6.2 (av. 4.4) mm. long, white to somewhat erubescens, the tube shorter to about equal to the lobes, the oblong lobes variable, 0.8–2.0 (av. 1.3) mm. wide, acute to slightly mucronate with usually an evident nerve. Stamens 2.4–5.0 (av. 3.6) mm. long, the frequently purple filaments broadened below, the usually purple anthers variable with or without an apiculate tip. Pistil 3.0–5.5 (av. 3.9) mm. long, the style 0.6–1.5 (av. 0.95) mm. long. Capsule 4.0–6.0 (av. 5.0) mm. long. Seeds averaging 0.15 x 0.10 mm.

Wet peaty barrens, sphagnum bogs, peaty margins of lakes and boggy depressions. Flowering from about mid-July to mid-September; fruiting from September to late October.

Representative specimens: Nfld. Head of Exploits River system, *Fernald & Wiegand* 6082 (GH, NY); Avalon Peninsula, *Fernald & Long* 26987 (GH, NY). N. S. Cape Breton County, Gabarus, *Rousseau* 35627 (GH); Digby County, Central Grove, *Gray Exsiccatae* 388 (GH, GA, DAO, NY, TENN, US).

Distribution by counties and districts: ST. PIERRE & MIQUELON: Island of St. Pierre; Island of Miquelon. CANADA. NEW BRUNSWICK: Charlotte. NEWFOUNDLAND: Green Bay, Burgeo and La Poile, Harbour Main-Belle Isle, Humber, Gander Falls, St. Barbe, St. Marys and St. Georges-Port au Port Districts. NOVA SCOTIA: Cape Breton, Cumberland, Annapolis, Digby, Guysborough, Halifax, Inverness, Lunenburg, Pictou, Queens, Richmond, Shelburne, Yarmouth and on Sable Island. MASSACHUSETTS: Barnstable and Nantucket. NEW YORK: Suffolk. RHODE ISLAND: Newport. VIRGINIA: Greensville.

3. *Bartonia verna* (Michx.) Muhl. Cat. 16. 1813.

*Centaurella verna* Michx. Fl. Bor. Amer. 1: 98. t. 12. f. 2. 1803. (*Michaux s.n. p.*, type the sheet from the Richard Herb. in the general herbarium, photo DAO!). *Centaureum vernum* (Michx.) Pers. Syn. Pl. 1: 137. 1805. *Centaurella vernalis* Pursh, Fl. Amer. Sept. 1: 99. 1814, ex char. *Centaurella vernalis*  $\beta$  *uniflora* Pursh. l.c. 100, ex. char. *Andrewsia verna* (Michx.) Spreng. Syst. Veg. 1: 428. 1825.

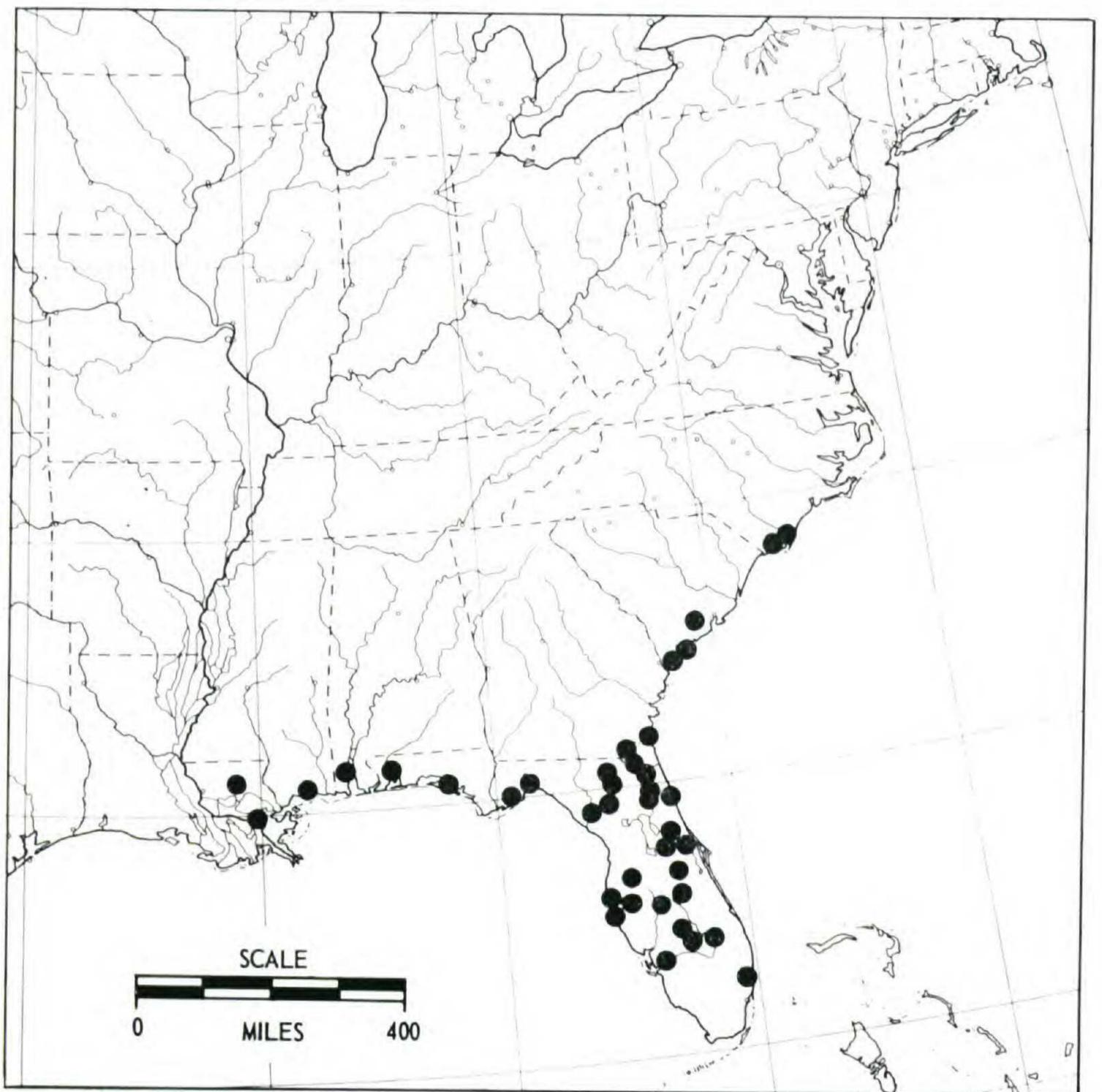
Annuals, 0.3–2.3 (av. 1.3) dm. tall, erect, simple, rarely branched above, the stem slender, angled but not winged, with few nodes, frequently purple. Leaves 0.6–3.0 (av. 1.9) mm. long, those subtending the upper flower to 3.5 mm. long, scale-like, usually opposite or subopposite, lanceolate to subulate. Flowers solitary, in terminal cymes, or with additional axillary flowers. Calyx lobes united only at the base, the lobes 0.9–2.8 mm. long, up to 1.5 mm. wide, lanceolate. Corolla white, the petals united only at the base, the lobes, 4.8–8.0 (av. 5.8) mm. long, 1.5–3.5 (av. 2.4) mm. wide, widely spreading, spatulate to obovate, obtuse, entire, with a single nerve. Stamens 3.0–4.8 (av. 3.6) mm. long, the filaments about 0.5 mm. wide at the base, flattened, tapering towards the apex, the anthers 0.5–1.1 (av. 0.8) mm. long, oblong, slightly incurved, dorsifixed, occasionally contorted after dehiscence. Pistil to 7.5 mm. long, ovate, the style about 2 mm. long, stout, the stigmas decurrent as far as the upper part of the ovary. Capsule ovate, slightly shorter than the marcescent corolla, the style persistent, dehiscence septicidal in the center of the capsule only. Seeds averaging 0.15 x 0.12 mm., light brown with a testa of round inflated cells, extremely numerous, over 1000 per capsule.

Moist pine barrens, sandy soil, edge of ponds, ditches and grassy depressions. Flowering from the first week of November until the first week of April. Seldom collected in mature fruit.

Common Names: White or Spring *Bartonia*.

Representative specimens: N.C. Brunswick County, Southport, *Godfrey 48001* (DAO, NY, US). S.C. Beaufort County, Fluffton, *Mellichamp in 1875* (NY). Ala. Damp pine barrens, *Mohr in 1898* (US). Fla. Brandenton, *Tracy 7540* (DAO, GH, NY, US); Hibernia, *Canby in 1869* (GH, NY, US).

Distribution by counties: ALABAMA: Mobile. FLORIDA: Alachua, Brevard, Broward, Clay, Columbia, Duval, Franklin, Glades, Gulf, Hardee, Highlands, Hillsborough, Lake, Lee, Levy, Manatee, Orange, Osceola, Pasco, Pinellas, Polk, Putnam, Santa Rosa, Seminole, St. Johns, Volusia, Wakulla and Walton. GEORGIA: Camden and Charleston. LOUISIANA: Orleans and Tangipahoa. MISSISSIPPI: Harrison. NORTH CAROLINA: Brunswick. SOUTH CAROLINA: Dorchester and Jasper.



MAP 3. Distribution of *Bartonia verna*.

There are two sheets of *Centaurella verna* Michx. in the Paris herbarium. I select the Richard collection in the General Herbarium as the type rather than the separate Michaux collection because it is more like the figure in the *Flora Boreali-Americana* (t. 12. f. 2.). Actually it is of little consequence which sheet is

selected for they are both the correct plant but the selection should be made in order to establish a single sheet as the type.

## DOUBTFUL AND EXCLUDED SPECIES

- BARTONIA ALBESCENS* Gill. & Arn. in Edinb. Geogr. Jour. 2: 278. 1831.  
 = *Nuttallia albescens* (Gill. & Arn.) Standl. in Jour. Wash. Acad. Sci. 6: 239. 1916.
- BARTONIA AUREA* (Nutt.) Lindl. Bot. Reg. 22; t. 1831. 1836.  
 = *Mentzelia aurea* Nutt. Gen. Am. Pl.
- BARTONIA DECAPETALA* Sims Bot. Mag. 36: t. 1487. 1812 (incorrectly attributed to Pursh by authors).  
 = *Mentzelia decapetala* (Sims) Urb. & Gilg in Engl. & Prantl, Nat. Pflanzenf. 3. Abt. 6a: 111. 1894.
- BARTONIA LAEVICAULIS* Dougl. ex Hook. Fl. Bor.-Am. 1: 221. t. 69. 1834.  
 = *Mentzelia laevicaulis* T. & G., Fl. N. Am. 535. 1840.
- BARTONIA MICRANTHA* (T. & G.) Hook. & Arn. in Bot. Beech. Voy. 343. t. 84. 1841.  
 = *Mentzelia micrantha* T. & G., Fl. N. Am. 535. 1840.
- BARTONIA MULTIFLORA* Nutt. in Jour. Acad. Sci. Phil. n.s. 1: 180. 1847.  
 = *Mentzelia multiflora* (Nutt.) A. Gray in Mem. Am. Acad. n.s. 4: 48. 1849.
- BARTONIA NUDA* Pursh, Fl. Am. Sept. 1: 328. 749. 1811.  
 = *Mentzelia nuda* (Pursh) T. & G., Fl. N. Am. 535. 1840.
- BARTONIA ORNATA* Nutt. Gen. N. Am. Pl. 1: 297. 1818.  
 = *Mentzelia ornata* (Nutt.) T. & G., Fl. N. Am. 534. 1840.
- BARTONIA PARVIFLORA* Dougl. ex Hook. Fl. Bor.-Am. 1: 221. 1845.  
 = *Touterea parviflora* (Dougl. ex Hook.) Rydb. in Bull. Torr. Bot. Cl. 30: 276. 1903.
- BARTONIA PUMILA* (T. & G.) Nutt. ex Jackson, Ind. Kew. 276. 1895.  
 = *Mentzelia pumila* T. & G., Fl. N. Am. 1: 535. 1840.
- BARTONIA SINUATA* Presl. Rel. Haenk.  
 (no other known combination in the Loasaceae).
- BARTONIA WRIGHTII* (Gray) Gray ex Jackson, Ind. Kew. 276. 1895.  
 = *Mentzelia wrightii* A. Gray, Pl. Fendl. 48, 1849.
- CENTAURELLA FESTIVALIS* Pursh, Fl. Am. Sept. 1: 100. 1814. The type has not been located and the description is inadequate to establish identity. This name is later than any employed in this treatment.

II. THE GENUS *OBOLARIA* L.

Although this monotypic genus has no specific problem, it seemed desirable to assemble the history and taxonomy because there has existed in the past a conflict over the family position and also because this information may assist in an understanding of generic relationships. In the following study, the range has been established, the type specimen sought out and the descrip-

tion amplified. A separate generic description has been drawn up which will emphasize those characters considered to be comparable with other gentianaceous genera. No direct relationship with *Bartonia* is implied by this arrangement.

*Obolaria* was described by Linnaeus in his *Hortus Cliffortianus* in 1737 under the spelling "Obularia" but was later redescribed and respelled *Obolaria* in the *Species Plantarum* and in the sixth edition of the *Genera Plantarum*. According to Article 74 (1) of the International Code, 1956, the latter spelling should be retained as the preferred spelling of Linnaeus.

Linnaeus considered that he was describing a relative of the genus *Orobanche* for in his *Mantissa* he wrote: "*folia suprema extus purpurea. Flores pallide rubentes. Orobanches affinis.*"

The unfortunate association with the *Orobanchaceae* begun by Linnaeus was continued by later authors, particularly by Grisebach, who ignored the genus completely in his treatment of the *Gentianaceae* in De Candolle's *Prodromus*. In a later volume of the work, however, Reuter included *Obolaria* in his treatment of the *Orobanchaceae*. Grisebach also omitted *Obolaria* from his *Species Gentianearum*. George Don placed it in the tribe OBOLARIEAE, the "terrestrial, not parasitical" *Orobanchaceae*.

The species was assigned to the genus *Shultzia* by Rafinesque in 1808. The earlier pre-Linnaean *Obolaria* of Siegesbeck was taken up for *Linnaea* L. of the *Caprifoliaceae* by Otto Kuntze in 1891 in his *Revisio Generum Plantarum*. In the same volume Kuntze adopted Rafinesque's name for the plant, recognized its position in the *Gentianaceae* and pointed out the need to distinguish it from *Schulzia* Spreng. of 1813 (*Umbelliferae*) named after Professor I. H. Schulz of Halle. According to Kuntze, Sprengel's name had been spelled "Schultzia" by many authors.

Gilg, in *Die Pflanzenfamilien* assigned *Obolaria* to the *Gentianaceae* subfamily *Gentianoideae*, under the group *Gentianeae-Erythraeinae* of unspecified rank. Gilg's grouping is a somewhat heterogeneous one having *Enicostemma*-like pollen as the chief feature in common. Of Gilg's list, *Sabatia* is the only genus that has been recently monographed, *Lapithea* being merged with it

(Wilbur, 1955). Beck-Mannagetta in his thorough treatment of the *Orobanchaceae* in *Das Pflanzenreich* (1897), omitted the genus *Obolaria* from the family and made no reference to it.

The uncertainty of family position has stemmed from Linnaeus's description and from the gross appearance of the plant. Although most of the *Orobanchaceae* are parasitic, there is no definite evidence that this is true for *Obolaria*.

The following characters will serve to establish a Pennywort as a member of the *Gentianaceae*:

OBOLARIA	OROBANCHACEAE
Placentae from the sutures with 1 lateral lamella per carpel (2)	Placentae non-sutural; 2 lateral branched lamellae per carpel (2-3)
Plants glabrous	Plants frequently pubescent
Autophytic or saprophytic with evident chlorophyll	Parasitic without chlorophyll
Actinomorphic corolla	Zygomorphic corolla with labelate lobes
Opposite leaves or bracts	Alternate leaves or scales
Stamens equal, 4 rarely 2 by abortion of the opposing pair; anther sacs normally developed.	Stamens didynamous; one anther sac frequently aborting.

#### SYSTEMATIC TREATMENT

**Obolaria** L. Sp. Pl. 2: 632. 1753, non *Obolaria* Siegesb. Prim. Fl. 79. 1736, ex Ktze. Rev. Gen. 275. 1891 = *Linnaea* L. (Caprifoliaceae). *Shultzia* Raf. Med. Repos. II. 3: 422. 1806, nom.; 5: 356. 1808 descr. & Jour. Bot. (Paris) 1: 219. 1809.

Perennial herbs with mycorrhizal fleshy corolloid bitter roots. Leaves opposite, decussate, sessile. Flowers in terminal dichasia or simple cymes and axillary. Calyx of two free sepals, usually with two decussate leafy bracts except in inner flowers of congested inflorescences, the sepals similar to the cauline leaves but more slender. Corolla 4-lobed, campanulate to urceolate, delicate but marcescent, without internal fimbriae or glands. Stamens 4, rarely 2, inserted at the sinuses of the corolla lobes, frequently appearing didynamous by partial abortion of the opposing pair, anthers 2-celled, introrse. Ovary unilocular, the parietal placentae sutural and with an additional lamellate intrusion on each of the two carpel walls. Stigmas two. Capsule unilocular, thin-walled, rupturing irregularly rather than by a terminal separation of the carpels. Seeds numerous.

1. *Obolaria virginica* L. Sp. Pl. 1: 632. 1753. (*Clayton* 286 BM, TYPE, photo DAO!).

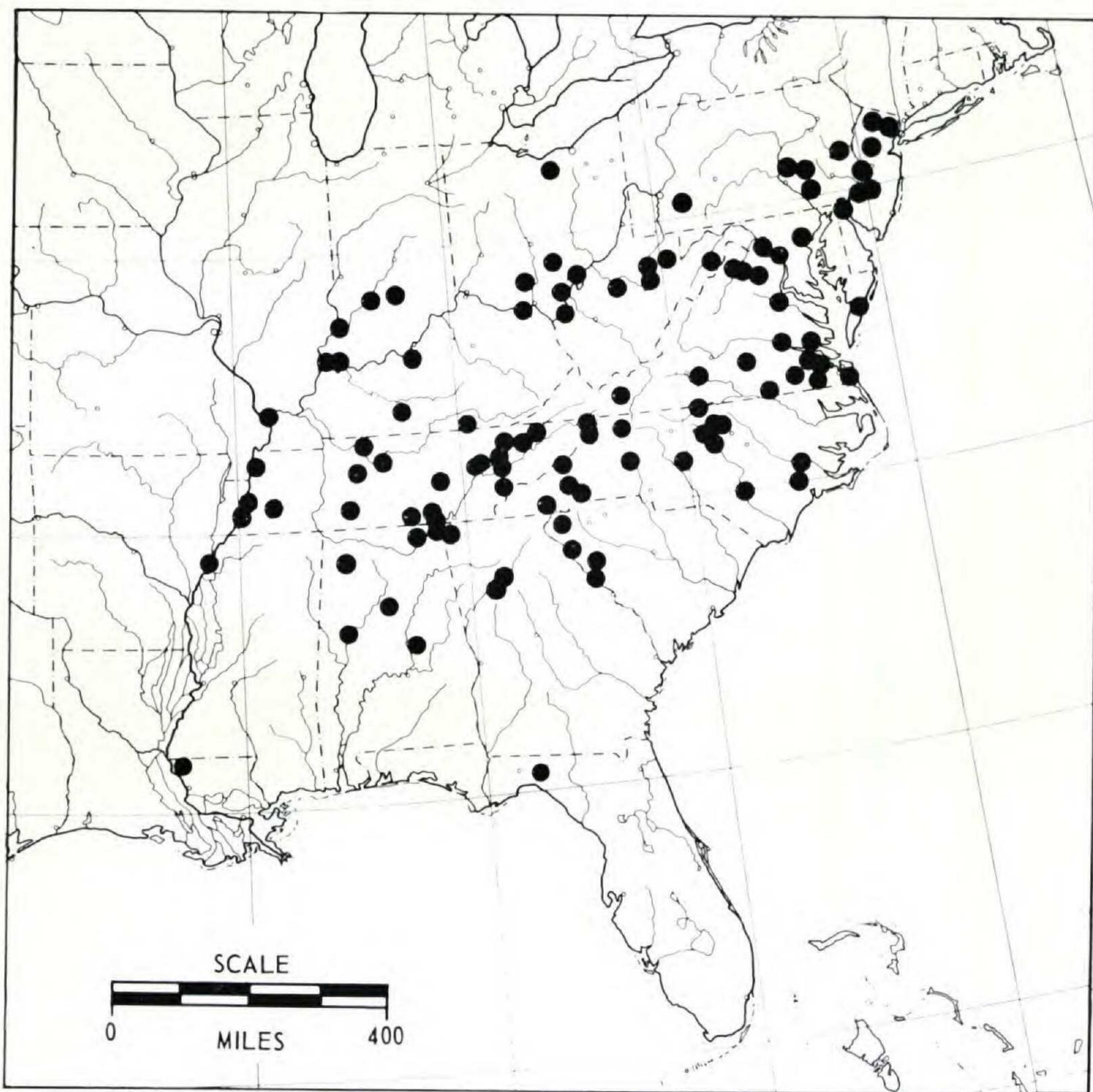
*Shultzia obolarioides* Raf. Med. Repos. II. 5: 356. 1808. *Shultzia virginica* (L.) O. Ktze. Rev. Gen. 2: 430. 1891.

Herbs 0.4–1.7 dm. tall, simple or strictly branched, the stem stout, fleshy and somewhat angled, frequently stouter above than below, occasionally fasciated. Lower cauline leaves 0.4–1.5 cm. long, 0.3–1.0 cm. wide, lunate, scale-like, loosely appressed, upper leaves becoming foliaceous or bract-like, closely subtending the flowers, fleshy, oblong to obliquely spatulate or soleaeform, truncate, abruptly acuminate, with numerous dichotomous veins anastomosing towards the tip, yellow to purple-green. Flowers short-pedicellate, the pedicels 0.5–2.0 mm. long. Corolla 0.6–1.2 cm. long (av. 0.9), white, campanulate with the lobes ascending, the tube 2.0–4.5 mm. long (av. 4.0), the lobes 4.5 mm. long, 2 mm. wide, oblong to slightly obovate, acute or strongly erose or irregular with entire margins, with three veins dichotomizing towards the apex. Stamens included, the short filaments 0.25 mm. wide, 1.0 mm. long, flattened, slightly tapered, the anthers 0.5 mm. long, dorsifixed, the thecae facing sideways after dehiscence. Pistil sessile, the ovary 3.0–3.5 mm. long, somewhat flattened, the style 1.0 mm. long, straight, the two stigmas 0.25 mm long, oblong and spreading. Capsule 5.5 mm. long, 3.5 mm. wide, ovoid, somewhat angular. Seeds averaging 0.23 mm. long, 0.16 mm. wide, light brown, ovoid, the surface minutely striate under X 60 magnification, approximately 1600 per capsule.

Rich woods, bottom lands, river banks, shrubby slopes, but chiefly in deciduous forest. Flowering from early March until late May; fruiting in late May and early June.

Distribution by Counties: ALABAMA: Blount, De Kalb, Franklin, Jackson, Tuscaloosa. ARKANSAS: Phillip. DELAWARE: New Castle. DISTRICT OF COLUMBIA. FLORIDA: Jefferson. GEORGIA: Dade, Fulton, Gwinnett, Rabun. ILLINOIS: Pulaski. INDIANA: Brown, Greene, Knox, Posey. KENTUCKY: Bullitt, Edmonson, Whitley. LOUISIANA: East Feliciana. MARYLAND: Baltimore. NEW JERSEY: Essex, Mercer, Somerset, Sussex, Union. NORTH CAROLINA: Buncombe, Caldwell, Craven, Cumberland, Durham, Henderson, Iredell, Jones, Macon, Madison, Orange, Polk, Wilkes. OHIO: Fairfield, Highlands, Jackson, Orain, Meigs, Scioto. PENNSYLVANIA: Berks, Bucks, Delaware, Chester, Lancaster, Lebanon, Montgomery, Northampton, Westmoreland. SOUTH CAROLINA: Anderson, Greenwood, Laurens, Oconee. TENNESSEE: Anderson, Blount, Carter, Cheat-ham, Davidson, Franklin, Grainger, Grundy, Hamilton, Hawkins, Jefferson, Knox, Lake, Lewis, Madison, Marion, Roane, Shelby, Sullivan, Tipton, Union, White. TEXAS: Location unknown. VIRGINIA: Accomac, Arlington, Bedford, Brunswick, Fairfax, Fauquier, Gloucester, Henrico, Isle of Wight, James City, Madison, Pittsylvania, Prince Edward, Prince William, Princess Anne, Southampton, Spotsylvania, Surry, Wythe. WEST VIRGINIA: Barbour, Cabell, Calhoun, Hardy, Upshur.

Linnaeus in his *Species Plantarum* gave a reference to the *Hortus Cliffortianus* where he wrote: "Crescit in Virginia, unde translatum communicavit DD. Gronovius." He also cited Gronovius' *Flora Virginica*. In this flora, "*Clayton n. 286*" is cited as it was by the younger Gronovius in the second edition of 1762. *Clayton 286* then may be considered as the type.



MAP 4. Distribution of *Obolaria virginica*.

There is no possibility of confusion with *Orobanche virginiana* L. Sp. Pl. 2: 633. 1753, because *Clayton 604* was cited by both Gronovius and by Linnaeus. This specimen located at the British Museum is the type of *Orobanche virginiana* L.

A total of 236 sheets have been seen from the herbaria listed in

Part I. Since there can be no confusion of species identity, no specimens have been cited.

## EXCLUDED SPECIES

OBOLARIA CAROLINIANA Walt. Fl. Car. 166. 1788.

= *Monniera caroliniana* (Walt.) O. Ktze. Rev. Gen. 2: 463. 1891 (Labiatae).

OBOLARIA BOREALIS (L.) Kuntze, Rev. Gen. 1: 275. 1891.

= *Linnaea borealis* L. Sp. Pl. 2: 631. 1753. (Caprifoliaceae)

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